

the face above; the apex of the clypeus is broadly pallid yellow and is sparsely punctured and almost bare. Mesonotum and scutellum distinctly brassy, closely punctured; the scutellum is broadly depressed in the middle. Post-scutellum unarmed and thickly covered with white pubescence. Basal area of median segment bare, shining and irregularly reticulated. Wings clear hyaline; the stigma and nervures black. Legs black, thickly covered with white hair; the hinder femora are dilated, above they have a rounded curve from the base to the apex; the tibiae are not much narrower than the femora and become gradually wider from the base to the apex, which is straight and oblique, their upper side is rounded, their lower straight; the calcaria and spines are pale. The abdomen at the base has bluish tints; the segments are ringed with white hair at the apices.

2. On *Lemur mongoz* and *Lemur rubriventer*.

By C. I. FORSYTH MAJOR, F.Z.S.

[Received March 4, 1901.]

(Plate XXII.¹)

(Text-figures 61-70.)

It is well known to those who have approached the subject that we are not yet satisfactorily acquainted with the members of the genus *Lemur*, and that the synonymy of the species is therefore far from being settled.

The reasons for this state of things are also known, at least in great part. Some of the species vary considerably in the coloration of their skin. In others the male is different from the female in outer appearance. In others again two different species resemble each other in external characters. Quite a number of so-called species have been introduced without sufficient descriptions, and, the types being lost or uncertain, it is impossible exactly to know what their authors had in view.

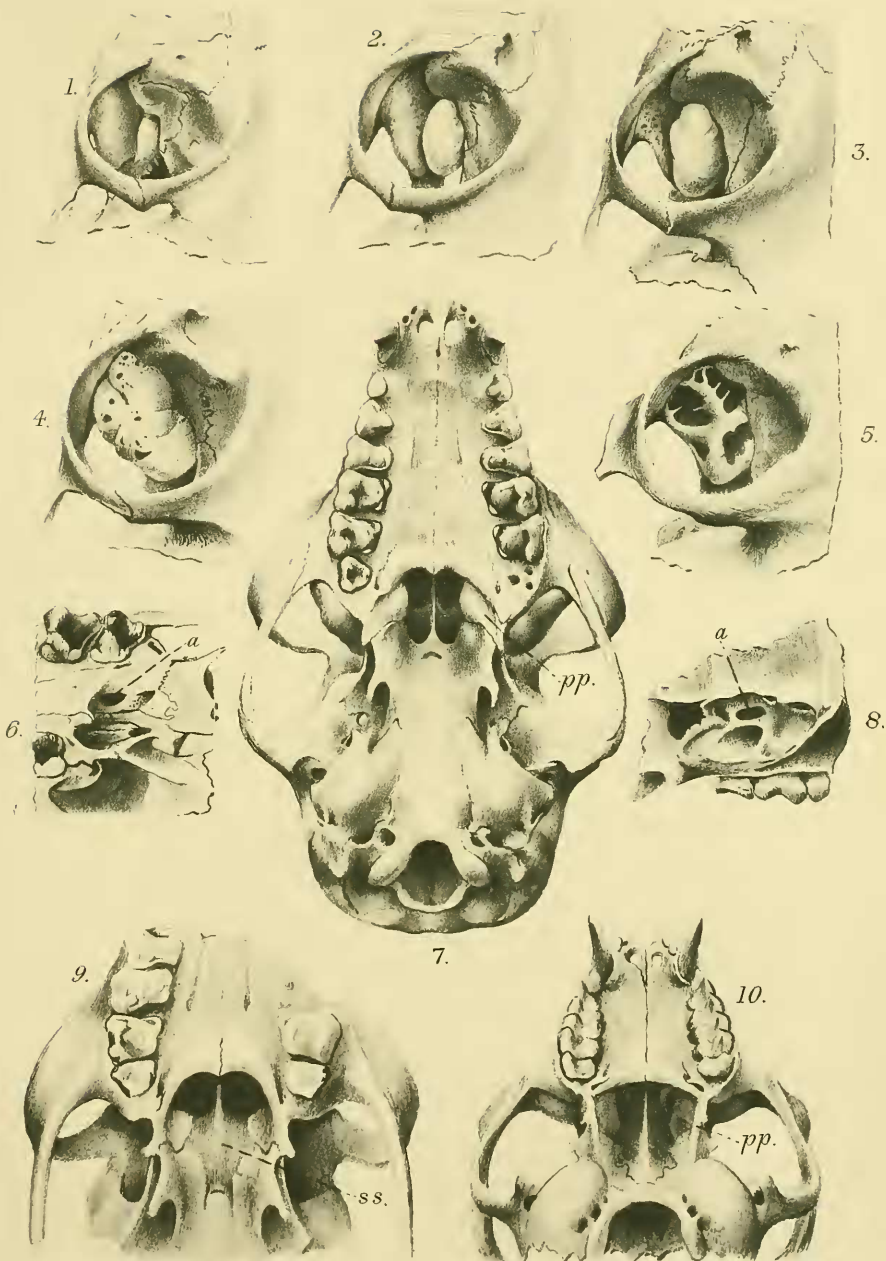
In menageries, different varieties of the same species, or two different species, have been again and again crossed together, and there is every likelihood that in more than one instance species have been founded upon hybrids.

With the exception of, perhaps, the Paris Museum, no collection contains sufficient materials for our present exigencies.

And, last not least, the species have without one single exception been based upon external characters, and the skull especially has been almost entirely overlooked.

Schlegel's excellent 'Monographie des Singes' of 1876, the fruit of researches extending over fifty years, is still the standard work from which we have to start when studying most of the

¹ For explanation of the Plate, see p. 268.



groups of the Primates. Although the author limited himself almost exclusively to outer characters, his practised eye very often, and, so far as the genus *Lemur* is concerned, as a rule, hit upon the truth. His shortcomings are due to the lack of sufficient collections, and the entire neglect of cranial characters, considered by him to be "un terrain glissant."

In the following paper I have done my best to contribute to a better knowledge of two species of the genus *Lemur*, with especial reference to some characteristic features of their skull. Incidentally have been pointed out the cranial characters of a third species, one which is almost always confused with *Lemur mongoz* L.

1. LEMUR MONGOZ L.

The Mongooz, G. Edwards, Gleanings of Natural History, Ch. v. pl. 126, p. 12 (1758).

Lemur mongoz, Linn. S. N. (12) i. p. 44 (1766); A. Wagner in Schreber's Säugethiere, Suppl. i. pp. 267, 268 (1840) (exc. p. syn.); id. op. cit. Suppl. v. p. 144 (1855) (exc. p. syn.); H. Schlegel, Nederl. Tijdschr. Dierk. iii. p. 75 (1866); H. Schlegel et Pollen, Rech. Faune Madag. ii. p. 4 (1868); P. L. Slater, Proc. Zool. Soc. Lond. 1871, p. 231 (exc. p. syn.); H. Schlegel, Mus. Hist. Nat. Pays-Bas, vii. p. 312 (1876); Jentink, Mus. Hist. Nat. Pays-Bas, ix. p. 62 (1887).

Lemur albinus, E. Geoffr. S.-H., Tabl. des Quadr. p. 160 (1812); I. Geoffr. S.-H., Cat. méth. p. 72 (1851); A. Milne-Edwards et Oustalet, Nouv. Arch. Mus. d'Hist. Nat. (2) x. p. 282 (1888); A. Milne-Edwards et A. Grandidier, Hist. Nat. des Mammifères (Hist. . . . de Madagascar, éd. A. Grandidier), x. tome v. Atlas ii. pls. 156, 157, 162-164, 165, figs. 1, 2 (1890); L. v. Lorenz-Liburnau, Abh. Senckenb. naturf. Ges. xxi. iii. p. 450, pl. xxxiii. fig. 2 (1898).

Mongous d'Anjouan, F. Cuvier (E. Geoffr. S.-H. et F. Cuvier), Hist. Nat. des Mammifères, 87, sub "Le Mongous," pp. 2 & 3 (1819).

Lemur dubius, F. Cuvier, op. cit. 93 (1834).

Lemur anjouanensis, Peters, Reise nach Mossambique, Zool. i. p. 21 (1852); Günther, Ann. Mag. Nat. Hist. (5) iii. p. 215 (1879).

Prosimia albimana, J. E. Gray, Proc. Zool. Soc. London, 1863, p. 139.

Lemur cuvieri, Fitzinger, Sitzungsber. Akad. Wiss. Wien, lxii. i. p. 58 (1870).

Anticipating the result of the following detailed review, I may state at once briefly the history of the name "*Lemur mongoz*."

Linnaeus based his species upon the tolerably good figure and the good description of "*The Mongooz*" in G. Edwards's Gleanings. Schreber¹ and soon afterwards Gmelin² extended the name to

¹ Die Säugethiere, i. p. 137 : "Der Mongus" (1774).

² Caroli a Linné, Systema Nat. xiii. ed. pp. 42, 43 (1788).

one or more other forms, quite certainly to one other species ; and this has been going on to the present day¹, although A. Wagner, Schlegel, and P. L. Sclater had, in succession, arrived at the truth. Sclater, moreover, was the first to point out that, as in some other species of the genus, the sexes have a different coloration in the true *L. mongoz*.

To begin with the description of "The Mongooz" by G. Edwards.

"The Mongooz is less than a small cat. This was a female.—The head of this animal is shaped much like that of a fox, and is wholly covered with hair ; the eyes are black, with orange-coloured irides, or circles round the eyes : the hair is black and joins between the eyes, tending downwards in a point toward the nose, which is also black ; but there is a space between the eyes and nose purely white, which reaches under the eyes, on the sides of the head. The upper part of the head, neck, back, tail, and limbs is of a dark-brownish ash-colour, the hair being something woolly ; the underside of the body is white . . . ; all the paws are covered with short hair of a light ash-colour ; the tail is long, the hair is pretty thick and soft, and appears to have a mixture of lighter and darker parts all over the body."

That E. Geoffroy Saint-Hilaire's *Lemur albinus* is a synonym of *L. mongoz* was not recognized at the time, because the species was founded apparently upon a male specimen, as results from the description of the coloration².

Possibly for the same reason Fr. Cuvier's excellent description of the "*Mongous d'Anjouan*" has been generally overlooked :—

"J'ai eu en même temps deux mâles et deux femelles de *Mongous*, auxquels la description que je viens de donner convenait également sous tous les rapports. Mais j'ai possédé un mâle qui avait avec ces animaux la plus grande ressemblance, et qui en différait cependant par quelques points assez remarquables pour que je croie devoir le faire connaître ici.

"Ce Maki avait été emmené d'Anjouan . . . Il était mâle et très-adulte, toutes les parties supérieures de son corps, et le sommet de la tête lui-même, étaient d'un gris jaunâtre, résultant de poils alternativement colorés sur leur longueur, de gris sale et de noir ; ce gris était plus pur sur les jambes de devant, et sur les côtés

¹ Cf. e.g. A. Milne-Edwards and E. Oustalet, *Nouv. Arch. Mus. d'Hist. Nat.* (2) x. p. 22 (1888).—A. Grandidier et A. Milne-Edwards, *Hist. Nat. des Mammifères* (Hist. . . de Madagascar, éd. A. Grandidier), v. Atlas ii. pls. 133–153 (1890).—F. A. Jentink, *Mus. d'Hist. Nat. des Pays-Bas*, xi. Cat. Syst. des Mammifères, pp. 68–72 (1892).—H. O. Forbes, *A Handbook to the Primates*, i. pp. 71–73 (1894).—Trouessart, *Catal. Mamm. tam viv. quam foss.* i. p. 57 (1898–99).

² "Pelage gris-brun en dessus : poils d'un roux cannelle sur les côtés du cou : poitrine blanche : ventre roussâtre : mains blanches" (Geoffroy Saint-Hilaire, *Tableau des Quadrumanes*, *Ann. Mus. d'Hist. Nat.* xix. p. 160, 1812).—"Gris en dessus avec la gorge et la poitrine blanches, le ventre roussâtre ; fraise d'un roux cannelle se prolongeant supérieurement assez pour entourer l'oreille. Ce dernier caractère distingue mieux l'espèce que la couleur des mains, qui sont blanchâtres ou d'un fauve sale" (I. Geoffroy Saint-Hilaire, *Catalogue méthodique*, p. 72, 1851).

du corps. La partie postérieure des cuisses de derrière était jaune, et ce caractère était remarquable. Le ventre était d'un jaune sale, et le gris-blanc dominait à la poitrine, au-dessous du cou, et de la mâchoire inférieure, et au-dessus de la supérieure. Enfin il avait, comme le *Mongous*, de larges favoris à la base des mâchoires, mais au lieu d'être orangés, ils étaient d'un roux sale. La forme de sa tête différait aussi sensiblement de celle du *Mongous* mâle: le crâne était plus élevé, le museau moins allongé, et il y avait une dépression à la racine du nez plus forte encore que celle qui se voit dans notre tête de *Mongous* femelle; enfin la partie antérieure du museau était blanche. Du reste, il ressemblait entièrement aux *Mongous*."¹

A. Wagner in his turn gives a good description of the species; from the following we are able to gather that his specimen was a female:—"Ein Halsband, das von den Ohren beginnt und um die Kehle herumzieht, der Unterhals, die Brust und ein schmaler Streif auf der Innenseite der Vorderglieder sind weiss; der Bauch und die Innenseite der Schenkel ist licht röthlichgelb. Die Stirngegend bis ausserhalb und unterhalb der Augen herab ist am dunkelsten und bildet eine fast ganz schwarze Querbinde; die Schnautze fällt mehr ins Weissliche, die Schnurren sind schwarz."² He also identifies Fr. Cuvier's *Mongous d'Anjouan*—to which Fitzinger subsequently gave the name of *L. cuvieri*—as belonging to *L. mongoz*, and likewise the *L. albinus* of Geoffroy Saint-Hilaire³. It is very probable that, as Wagner and several of the following writers have maintained, the *L. nigrifrons* of E. Geoffroy Saint-Hilaire is likewise a synonym of *L. mongoz*.

In the fifth Supplement of Schreber's 'Säugethiere,' Wagner has unfortunately up to a certain extent again undone his previous good work. Cuvier's *Mongous d'Anjouan* is here⁴ excluded from the synonymy of *L. mongoz* on the ground that it had red whiskers, which was not the case in Geoffroy's and Peters's specimens from Anjouan⁵. Wagner therefore now ranges it under *L. collaris*⁶, as he does likewise with *L. albinus*.

The fact is, that Peters's specimen was a female.

In his eight days' sojourn at Anjouan, one of the Comoros, Peters obtained a young male and an "older" female of "*Lemur anjouanensis*." The female is described as follows:—"Gesicht und Schnauze schwarz, Oberkopf, Nacken, Ober Rücken, Schwanz und die Aussenseite der Vorderextremitäten grau, der übrige Theil des Rückens bis zur Schwanzbasis und die Hinterextremitäten graubraun, die Seiten des Gesichts bis zu den Ohren, die Kehle, Brust und die innere Seite der Vorderextremitäten bis zu den Pfoten weiss, der ganze Bauch bis zur Schwanzbasis rostbraun, die nackten

¹ Hist. Nat. Mammifères, 87, sub "Le Mongous," pp. 2 & 3 (1819).

² Schreber's Säugethiere, Suppl. i. p. 268.

³ *Op. cit.* p. 269.

⁴ Schreber's Säugethiere, Suppl. v. p. 145.

⁵ Peters's specimen was a female; see below.

⁶ *Op. cit.* p. 145.

Theile des Gesichts und der Hände schwarz. Die Länge des Thiers von der Schnauzenspitze bis zur Schwanzbasis betrug im frischen Zustande 13 engl. Zoll . . .”¹

H. Schlegel repeatedly asserted, between the years 1866–1876², that with the real *Lemur mongoz* of Linnæus, based on the “Mongooz” of G. Edwards, has been almost constantly confused a different species, for which he adopts the name *L. collaris* E. Geoffr. S.-H. He showed that, apart from *L. catta*, which stands aside from all the other species of the genus, these last may be divided into two groups—those with a black snout, and those in which “all the parts of the snout are covered with white hairs.” To the latter group belong the *L. mongoz* L. and the *L. coronatus* Gray.

Thirty years ago³, the Secretary of this Society “submitted as an hypothesis to be confirmed by subsequent investigation,” that two kinds of Lemurs in the Society’s Gardens, the “Yellow-cheeked” and the “Black-fronted,” hitherto regarded as distinct species, were really male and female of the same species, to which the earliest name applicable appears to be the *L. mongoz* of Linnæus, founded on the “Mongooz” of Edwards, a female. The female specimens of the Gardens are said to be certainly the animal figured by F. Cuvier (Hist. Nat. des Mammifères) as “Le Maki à gorge blanche, femelle—*Lemur dubius*.” Now, certainly not all the “Yellow-cheeked” Lemurs are the males of the species *L. mongoz*, nor are all the “Black-fronted” its females. But neither was this Slater’s view of the question, for he expressly states as his opinion that F. Cuvier’s *L. nigrifrons* and Gray’s *L. xanthomystax* are different.

In his ‘Monographie des Singes,’ Schlegel partly endorses Slater’s view, which on the whole was a confirmation of his own. He omits, however, from the synonymy of *L. mongoz* the *L. collaris* of E. Geoffroy S.-H., on the other hand adding to it *L. albinus* of the same author.

From Schlegel we also obtain, for the first time, information about the exact locality where the species was found in Madagascar; most of the specimens in the Leyden Museum were obtained by the Dutch collector Van Dam near Bembatoka Bay, West Coast of Madagascar. The description of the skin is given as follows:—

“Teinte dominante d’un gris brunâtre, plus ou moins lavé de roussâtre et tiqueté de noir. Dessous blanchâtre, quelquefois roussâtre, ou même teint comme les parties supérieures. Teintes de la tête assez différentes dans les deux sexes : le mâle ayant les

¹ Reise nach Mossambique, Zool. i. p. 21 (1852).

² H. Schlegel, Contributions à la Faune de Madagascar et des Iles avoisinantes : Nederlandsch Tijdschrift voor de Dierkunde, iii. p. 75 (1866).—Schlegel et Pollen, Rech. sur la Faune de Madagascar et de ses dépendances. II. Mammifères et Oiseaux par H. Schlegel et François P. L. Pollen, p. 4 (1868).—H. Schlegel, Mus. d’Hist. Nat. des Pays-Bas, vii. Monogr. des Singes, p. 312 (1876).

³ P. L. Slater, “Notes on rare or little-known Animals,” Proc. Zool. Soc. London, 1871 (p. 230).

favoris, un bandeau frontal ou même tout le front et le vertex d'un roux vif; tandis que la femelle offre des favoris blancs et un large bandeau noir sur le devant du front, sans nulle trace de roux. Ce bandeau noir est très caractéristique pour la femelle du Mongoz, et ne se retrouve pas non plus dans aucune autre espèce du genre."¹

Four specimens of a Lemur collected by Mr. C. E. Bewsher in Anjuan and preserved in the British Museum have been described by Günther, likewise under the name *L. anjuanensis*. It is stated that Peters's description of the female "agrees entirely with a specimen of the same sex obtained by Mr. Bewsher." The three males are exactly alike; "the face before the eyes is white, the nose blackish, the forehead with mixed black and whitish hairs; the side of the throat below the eye, and the throat itself, bright brownish red; crown, back, outer side of the legs, and the greater part of the tail grey, with a not very perceptible rufous tinge on the rump; chest and abdomen greyish, with a rufous tinge; inner side of the legs with scarcely any white; hands and feet grey (in one specimen whitish); the terminal third or fourth of the tail blackish."²

It will have been observed that Peters states the snout of the female to be black. The female in the British Museum, said by Günther to agree with the one described by the former writer, has only the tip of the nose black. Peters may have used the term "Schnauze" in a loose sense, or he may have disregarded the whitish hairs covering the dark skin of the snout³. The agreement with the British Museum specimens from Anjuan is so perfect in all the other characters, that I have given Peters's specimen a place in the synonymy of *Lemur mongoz*.

A specimen in the British Museum (Z. D. No. 79.11.12.7), collected by Dr. (Sir John) Kirk in another of the Comores, Mohilla, agrees exactly in the characters of the skin with the male specimens from Anjuan. The cranial characters are those of the species under consideration (see below). This is the only record of a *Lemur* occurring in Mohilla Island.

In their "Etudes sur les Mammifères et les Oiseaux des Iles Comores"⁴, A. Milne-Edwards and Oustalet state that the species of *Lemur*, common in the forests of the Island of Anjuan, at about 1000 metres, is the *Lemur albimanus* E. Geoffr. S.-H. They deny that this species has ever been found in Madagascar: "Le *Lemur albimanus* a été décrit par Geoffroy Saint-Hilaire d'après un exemplaire de la collection du Muséum rapporté par Péron et Lesueur, lors de l'expédition de la corvette le *Géographe*, en 1803, et indiqué comme recueilli à Madagascar. Or jamais, à notre

¹ *Op. cit.* p. 312. Schlegel adds: "M. Selater a indiqué à l'inverse le sexe de ces deux individus." This applies, of course, only to the explanation of the figures in pl. xvi. of the P. Z. S. 1871.

² Ann. Mag. Nat. Hist. (5) iii. p. 215 (1879).

³ Cf. plates 162-165 in Grandidier's Atlas.

⁴ Nouv. Arch. Mus. d'Hist. Nat. (2) x. p. 222 (1888).

connaissance, cette espèce n'a été trouvée sur cette grande terre et il est probable que la provenance avait été donnée d'une manière approximative par Péron et Lesueur, ce qui n'étonne pas quand on sait combien, à cette époque, on attachait peu d'importance aux questions de Géographie zoologique."¹ From the description they give of this Lemur² it is quite evident that we have not only the same species as that described by Peters and by Günther, but also the one described by Slater and by Schlegel; but both the last-named writers, and especially the latter's statement about the occurrence of the species on the West Coast of Madagascar, are overlooked.

In the same article³, the two French zoologists mention a second species of *Lemur* from Anjuan, under the name of *L. mongoz* L. (= *L. nigrifrons* E. Geoffr. S.-H.), adding that the type of Geoffroy's *L. anjuanensis*, in the Paris Museum, is a synonym of the former. As Günther had already pointed out⁴, E. Geoffroy's diagnosis of his *L. anjuanensis*⁵ can be applied to more than one species. Schlegel made, with regard to the "*Lémur de l'île d'Anjuan, Lemur anjuanensis*," the vague statement that persons who have seen specimens pronounced them not to be different from the ordinary *L. collaris*; although he refers to Peters's description, he overlooks that the description of the female in the '*Reise nach Mossambique*' corresponds exactly with his own description of the female from Bembatoka⁶. With regard to E. Geoffroy's *L. anjuanensis*, in the absence of a more accurate description, we must rely on Milne-Edwards's and Oustalet's assertion, that the type is distinct from the same author's *L. albigimanus*. As a consequence, the name *L. anjuanensis* cannot stand for the Lemur described from Anjuan by Peters and by Günther, nor as a synonym of *L. mongoz* L.

Bearing in mind what Milne-Edwards, Grandidier's collaborator in the work on Madagascar, asserts about the patria of *L. albigimanus* (see above), we must assume that the plates of "*Lemur albigimanus*" in the '*Histoire de Madagascar*,' issued two years later, in 1890⁷, were drawn after specimens from Anjuan. The

¹ *Op. cit.* p. 223.

² "Les mâles diffèrent beaucoup des femelles, ils ont tous une fraise jaune; les femelles ont la poitrine blanche, la teinte du corps varie plus ou moins du gris au roux, mais les caractères que nous venons d'indiquer sont constants et se remarquent même chez les jeunes sujets" (*op. cit.* p. 223).

³ *Op. cit.* p. 222.

⁴ *Op. cit.* p. 216.

⁵ "Pelage roux-vif en dessus, gris-roux sur les membres: les parties antérieures du tronc cendrées" (Ann. du Mus. vol. xix. p. 161). I. Geoffroy S.-H.'s diagnosis is slightly more complete: "Gris en dessus et en dessous jusqu'aux épaules; roux en dessus et en dessous dans tout le reste du corps; queue et cuisse rougeâtres" (Cat. Méth. p. 73, 1851). Whatever the habitat of this type of *L. anjuanensis* may be, the above diagnoses, insufficient as they are, support Milne-Edwards's and Oustalet's view that this species is different from *L. albigimanus*.

⁶ *Op. cit.* p. 309.

⁷ Pls. 156, 157, 162-164, 165, figs. 1 2.

sex has been wrongly indicated in the plates 156, 157, and 162, just as in Sclater's figures.

From the descriptions by Günther, Schlegel, Milne-Edwards and Oustalet, and from Grandidier's plates, we learn that, apart from the very characteristic coloration of the throat and front, different in both sexes, the colour of the skin varies to some extent, although on the whole the males are more reddish, the females more greyish.

Von Lorenz describes our species from specimens collected by Dr. Voeltzkow at Kandani and Antema, near Bembatoka Bay, the same district whence the Leyden specimens were obtained. Although the description is given under the heading "*L. albimanus*," the writer states expressly that he inclines to agree with Schlegel and Sclater in assuming that the appropriate name is *L. mongoz* L. Von Lorenz also records that, out of twenty individuals, two females approached to the coloration of the males, and *vice versa* one male had a grey head¹.

I trust that by the foregoing quotations the synonymy of *L. mongoz* L., placed at the heading, has been justified, and that its outer characters have been abundantly pointed out.

It is a matter of considerable difficulty to find out the proper name for the one species with which the *Lemur mongoz* L. is generally confused. Schlegel adopted for it the name *Lemur collaris* Geoff., but the descriptions of the older writers are mostly insufficient, so that, if the types are not forthcoming, the matter will never be satisfactorily settled. All I wish to say for the present on this subject, with which I am not directly concerned here, is, that there exists in Madagascar and the Comoros a widespread species, varying considerably in the colour of its skin, but constant in some cranial features of easy observation, which last will be described farther on. To this species, besides the name *L. mongoz*, the following names have been applied at one time or other:—*Lemur albifrons*, *L. anjuanensis*, *L. bruneus*, *L. collaris*, *L. fulvus*, *L. mayottensis*, *L. nigrifrons*, *L. rufifrons*, *L. rufus*, *Prosimia melanocephala* and *Prosimia xanthomystax*. *L. fulvus* E. Geoffr. S.-H. has the priority, and I therefore adopt this name.

Cranial Characters.

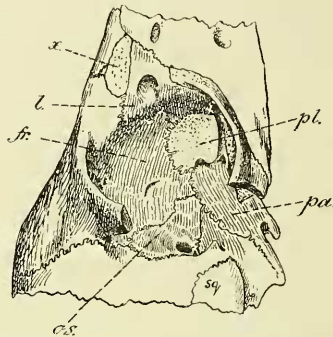
Lemur mongoz has the smallest skull of all the species of the genus, *L. coronatus* not excepted. Assuming that Edwards's specimen was adult, the dimension assigned to it, "less than a small cat," would be appropriate. As observed by F. Cuvier and von Lorenz, the facial cranium is short for a species of *Lemur*; it approaches in this character the *L. rubriventer*.

Von Lorenz has figured the skull in the side view, which he describes as follows: "Die Stirne ist in Folge der stark entwickelten Sinus frontales weit vorgewölbt und von der Nasenwurzel

¹ Abb. Senckenb. naturf. Ges. xxi. iii. p. 450 (1898).

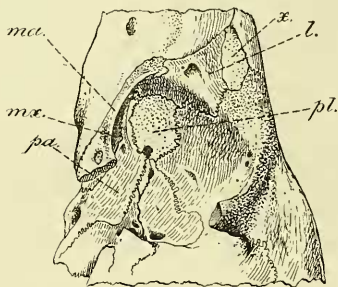
an ziemlich steil ansteigend, doch zeigen die verschiedenen Individuen eine sehr wechselnde Entwicklung der Stirnhöhlen; bei einigen beschränken sie sich mehr auf den vorderen Theil der Frontalia, bei anderen verursachen sie auch eine Vorwölbung der hinteren Partien und der verticalen Fortsätze der Stirnbeine. Mit

Text-fig. 61.

Right orbital region of *Lemur catta*, nat. size (Br. M. 59 c).

l.=lacrymal; *pl.*=planum; *fr.*=frontal; *pa.*=palatal; *os.*=orbito-sphenoid;
sq.=squamosal; *x*=intercalar bone.

Text-fig. 62.

Left orbital region of the same specimen of *Lemur catta*, nat. size.

ma.=malar; *mx.*=maxillary.

dem Geschlechte stehen diese Unterschiede in keinerlei Zusammenhang"¹. The specimens from Anjuan and Mohilla before us agree with the foregoing descriptions.

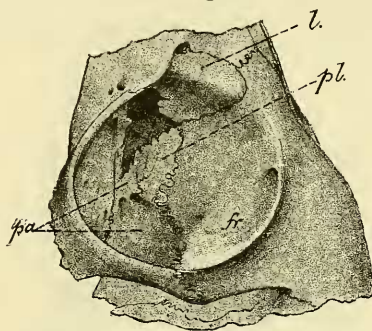
Still more characteristic for the present species are some peculiarities in the basis cranii, due also to pneumatic cavities.

The conditions of these pneumatic cavities, which give a

¹ *Op. cit.* p. 452, pl. xxxiii. fig. 2.

characteristic feature to the skull of *Lemur mongoz*, are so peculiar in this and the following species (*Lemur rubriventer*) that, in order to understand them, some general considerations must precede their description.

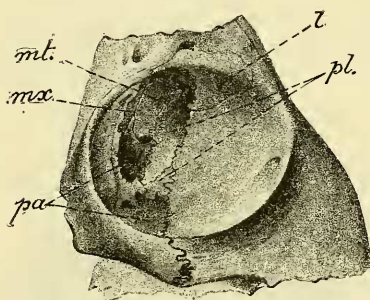
Text-fig. 63.



Left orbital region of *Lepidolemur mustelinus*, $\frac{2}{3}$ nat. size.

(Letters as in text-fig. 61.)

Text-fig. 64.



Lepidolemur mustelinus.

Same specimen as fig. 63. The bones forming the roof of the sinus have been removed, in order to exhibit its floor.

mt.=basal plate of maxillo-turbinal; other letters as in text-fig. 61.

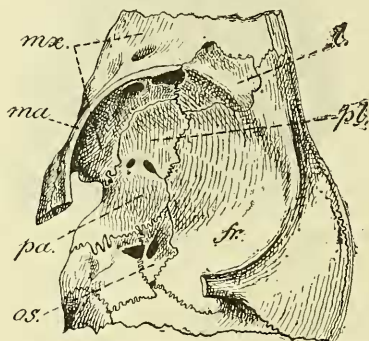
It has been stated that in the "Common Lemur"—whereby I take the genus *Lemur* to be implied—"the os planum of the ethmo-turbinal does not enter into the inner wall of the orbit, but is shut out from it by the maxilla, as in most inferior Mammals"¹.

At this Society's meeting on February 19th, I showed that in

¹ W. H. Flower, An Introduction to the Osteology of the Mammalia, 3rd ed., p. 166 (1885).

all the Oriental and Ethiopian Lemurs, as well as in the Malagasy *Microcebus*, an os planum is always very evident, so long as the sutures in the orbit remain distinct, adding that, with the exception of *Chiromys*, I had observed the os planum in all the Malagasy Lemurs in which sufficiently young stages could be examined. In the majority of the Malagasy Lemurs the frontal, and here and there to a slight extent the orbito-sphenoid—not the maxilla—overgrew the medial part of the planum. The

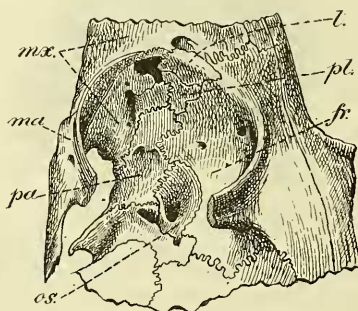
Text-fig. 65.



Left orbital region of *Lepidolemur mustelinus* (Br. M. 97.9.1.18), $\frac{3}{2}$ nat. size.

ma.=malar; mx.=maxillary; other letters as in text-fig. 61.

Text-fig. 66



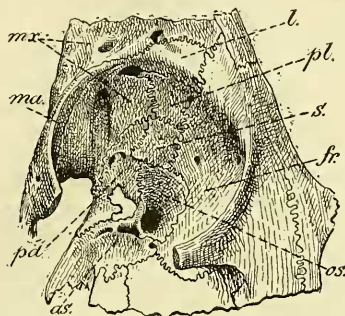
Left orbital region of *Lepidolemur globiceps* Maj. (Br. M. 97.4.6.1), $\frac{3}{2}$ nat. size.

mx.=maxillary; ma.=malar; other letters as in text-fig. 61.

lateral part has become united with the palatal at a very early stage; a remnant of the suture with the latter bone is seen in the adult at its antero-medial extremity; in exceptional cases, e. g. *Lemur catta* and young specimens of *Lepidolemur*, the planum remains completely (*pl.*, text-fig. 62, p. 256) or almost completely (*pl.*, text-fig. 63, p. 257) distinct from the palatal (text-figs. 61,

62). It always forms the roof of a pneumatic cavity, which often (*Lemur catta*, *Lemur macaco*, *Lemur varius*) is but an appendix of the maxillary sinus. The anterior portion of the palatal also participates, as a rule, in the formation of this

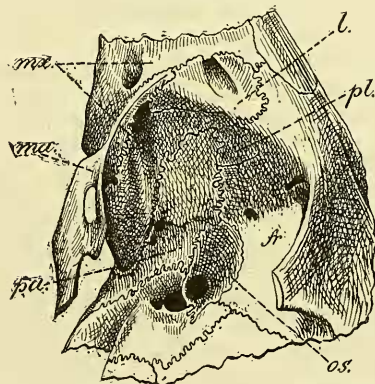
Text-fig. 67.



Left orbital region of *Lepidolemur grandidieri* (Br. M. 68.9.7.4), $\frac{3}{2}$ nat. size.

S.=intercalary bone; os.=alisphenoid; mx.=maxillary; ma.=malar; other letters as in text-fig. 61.

Text-fig. 68.



Reversed right orbital region of *Haplolemur griseus* (Br. M. 67.9.1.12), $\frac{3}{2}$ nat. size.

mx.=maxillary; ma.=malar; other letters as in text-fig. 61.

pneumatic cavity, by forming its posterior *cul-de-sac* (text-figs. 63, 64, p. 257). But the early union of the palate-bone with the planum renders it very difficult to state for every genus and every species, where no young stages were available and no sections could be made of the skull, in what degree, if at all, the palatal partakes in the formation of the walls of the pneumatic cavity.

With regard to the Oriental and Ethiopian Lemurs, all of which, as stated, have a well-developed planum and in all of which the orbital process of the palatal is small, I submit, pending a more accurate investigation, that this process belongs to the palatal exclusively.

In the Malagasy Lemurs, in which part of the planum is shielded by the frontal, the anterior prolongation of the orbital process is large (*Microcebus* occupies an intermediate position between the Malagasy and non-Malagasy Lemurs) (text-figs. 65, 66, p. 258). For the reasons stated above, I have submitted, that in this group the larger portion of the orbital process is in reality a part of the planum, which, in union with a small portion of the palatal, helps to form the walls of a pneumatic cavity. There are cases, however—*Haplolemur* and sometimes *Lepidolemur* (text-figs. 67, 68, p. 259)—in which occurs besides a separate bone, which, from its position, has the claim of being a small independent portion of the planum. So that in these exceptional cases the planum is represented by three distinct portions—one covered by the frontal, another contributing towards the formation of a sinus, and a third, which plays the usual part of a planum, but is greatly reduced in size. This last can scarcely be regarded as a stop-gap, an intercalary bone, for in the case of *Haplolemur* at least it is already present in a new-born specimen.

In *Man*, the orbital process of the palatal is more or less hollow and completes, so to say, one of the ethmoidal cells, by closing it. In very exceptional cases (M. J. Weber) this cavity of the human palatal opens into the maxillary sinus.

The palatal of *Man* is, according to the general assumption, developed from a single osseous centre. But Cleland has drawn attention to the circumstance¹ that, not uncommonly in *Man*, the orbital process is unusually large, owing, he believes, to its having incorporated one of the three elements of the sphenoidal spongy bones (ossicula Bertini); for it has the same position which is occupied by that element when it appears in the orbit, and the enlarged orbital process replaces the element by contributing towards the formation of the lateral wall of the cavity (sinus sphenoidalis) which owes its origin to the spongy bones. In three young Orang skulls Cleland found that "the sphenoidal spongy bones take part in the formation of the orbit, while the palatal has no orbital plate"².

Henle holds that part of the processus orbitalis helps to close the sinus sphenoidalis when its wall is incomplete³. A similar view is advocated by Toldt⁴, who says that when the spongy bones are rudimentary, the orbital process may contribute in a comparatively

¹ Phil. Trans. Roy. Soc. London, vol. 152, pp. 291, 292 (1862).

² *Op. cit.* p. 297.

³ "Was von der Grundfläche des Proc. orbitalis hinter seiner Öffnung übrig bleibt, legt sich vor die laterale untere Ecke der vorderen Wand des Wespenbeinkörpers und trägt, wenn diese Wand unvollständig ist, zur Schliessung der Wespenbeinhöhle bei." (Handb. d. syst. Anat., 3rd ed., I. i. p. 190, 1871.)

⁴ Lotos, Jahrb. f. Naturwiss., N.F. iii. & iv. p. 75 (1883).

large measure towards the formation of the wall of the sinus sphenoidalis; or else this function may be taken over by an *intercalary* bone making its appearance in the most posterior part of the medial orbital wall and articulating with the same bones as does the "third element" noticed by Cleland.

Gegenbaur states¹ that the *superficies sphenoidalis* of the orbital process, situated behind the latter's *superficies ethmoidalis*, articulates with the body of the sphenoid, from the cavity of which a hollow ("Buchtung") extends on to the sphenoidal surface, and he accordingly figures² a small cavity in this part of the orbital process, almost symmetrical with, but smaller than, the cavity of the ethmoidal surface.

There is therefore no perfect accord amongst the writers on this topic—Gegenbaur representing as the normal condition what by other anatomists is termed an occasional occurrence; and, like Henle before him, he does not speak of an articulation of the orbital process with the ossicula Bertini, but with the præsphenoïd.

In Lemurs—*Lemur fulvus* ("L. mongoz," B.M. Z. D. No. 60 b), *Lepidolemur* (see text-figure 67, p. 259), *Avalis* (see s., text-figure 27, above, p. 132)—I find sometimes present a separate bone, occupying exactly the position of Cleland's "third element"³ and Toldt's "Schaltknochen." In one instance at least amongst Lemurs (see below under *Lemur rubriventer*), the anterior portion of the sphenoidal sinus is annexed in a later stage by a palatal sinus.

I am likewise inclined to assume that the small cavity in the human orbital palatal communicating with one of the ethmoidal cells is the remnant of the condition in Lemurs, where ethmoid and palatal concur in forming a cavity. From this it follows that the so-called "cellulæ ethmoidales" are not organites proper only to the ethmoid of Man, and hence are not without phylogenetical importance, as assumed by Seydel⁴.

Proceeding now to an examination of the conditions in *Lemur mongoz*, I find that in all the skulls of this species which I had the opportunity to examine the *pars perpendicularis* and the orbital process of the palatal diverge considerably from behind forward, so as to enclose between them the posterior triangular portion of a spacious cavity. The divergence of the *pars perpendicularis* takes place by its advancing into the *cavum nasale* from behind forwards in a latero-medial direction, so that the two parts of either side converge slightly towards the middle line (Pl. XXII. fig. 10, p.p.); each of them terminates freely with a sharp vertical margin, which forms the posterior boundary of the large opening of the cavity into the *cavum nasale*. The divergence of the orbital process is produced by its being inflated in a lateral direction. The vaulted

¹ C. Gegenbaur, Lehrb. d. Anat. d. Menschen, 6te Aufl., i. p. 234 (1895).

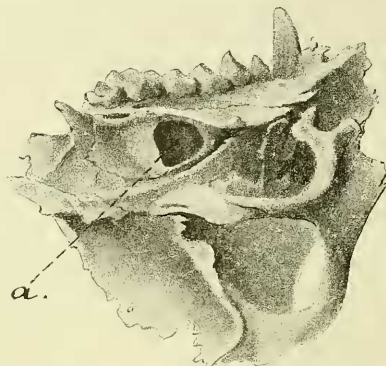
² *Op. cit.* p. 233, fig. 176 C.

³ "Articulating behind with the sphenoid, in front with the ethmoid, inferiorly with the palatals, and sometimes [in Lemurs always—F. M.] above with the frontal."

⁴ Morph. Jahrb. xvii. pp. 86, 89 (1891).

roof of the cavity has invaded the whole bottom of the orbit; bearing in mind what I stated in the above introductory remarks, it may be assumed that the planum, possibly some part of the sphenoid also, shares with the palatal the roofing of this cavity. The sutures having disappeared (text-fig. 69), I must leave this to future investigation.

Text-fig. 69.



Right palatal view of *Lemur mongoz*, showing the large opening (*a*) of the right-side sinus into the cavum nasale. Nat. size.

It has been stated above that the medial and lateral walls of the triangular posterior portion of the cavity are formed by parts of the palatal. The anterior portion is triangular also, but the apex is at its anterior end; the walls of this anterior portion are formed by parts of the ethmoid, the medial wall by the basal plate of the maxillo-turbinal, the posterior free margin of this plate, which is concave backward, forming the anterior boundary of the large opening of the cavity. This aperture (*a*, in text-fig. 69) therefore has somewhat the shape of a D, placed parallel to the long axis of the skull, the curved part anteriorly; the vertical part of the D is the posterior margin of the opening. The anterior and lateral walls of the cavity are apparently formed by the planum, the former of the two at the same time marking the boundary between this cavity and the true maxillary sinus, which in this species does not advance into the orbit; nor can I see any communication between the two cavities. The bottom of the cavity under consideration is formed by the bony palate, almost exclusively by the maxilla; the alveoli of the two anterior true molars protrude into it.

The characteristic features of this cavity, as compared with other species, are:—

- (1) its large opening;
- (2) its not being connected with the maxillary sinus (into the bottom of which always protrude the two posterior pre-molars); and

- (3) the characteristic position of its postero-medial wall, as seen from behind, when the skull is held in a horizontal position, with the basis directed upwards (Pl. XXII. fig. 10).

There are other species of Lemurs (e g., *Lemur macaco*, *Lemur nigerrimus*, *Lemur coronatus*) in which the pars verticalis of the palatal advances into the cavum nasale in a slightly oblique direction; but in none does it form a high vertical wall as in *Lemur mongoz*, which therefore is by this character alone at once to be distinguished from all the other species.

Lemur fulvus, generally confused with *Lemur mongoz*, is precisely the one which exhibits no trace of a similar wing-like structure, there being no pneumatic cavity intercalated between the posterior region of the orbit and of the cavum nasale respectively. An equally striking character of the skull of *Lemur fulvus* is the great vertical extension of the sphenoidal sinus (Pl. XXII. fig. 9, ss), which produces a considerable and sudden change of level between this part of the basis and the cavum nasale in advance of the sinus sphenoidalis, the former coming to be situated much higher¹.

2. LEMUR RUBRIVENTER.

Lemur rubriventer, I. Geoffr. S.-H., C. R xxxi. p. 876 (1850); id. Cat. méth. p. 71 (1851); H. Schlegel, Nederl. Tijdschr. Dierk. iii. p. 75 (1866); id. Mus. Hist. Nat. Pays-Bas, vii. p. 311 (1876); Jentink, Mus. Hist. Nat. Pays-Bas, ix. pp. 61, 62 (1887) (exc. cran. nos. o, p, s); A. Milne-Edwards et A. Grandidier, Hist. Nat. des Mammifères (Hist. . . . de Madagascar, éd. A. Grandidier), x. tome v. Atlas ii. plates 168-170 (1890); Jentink, op cit. xi. pp. 72, 73 (1892) (exc. sp. d); Forsyth Major, Proc. Zool. Soc. Lond. 1899, p. 554.

Lemur flaviventer, I. Geoffr. S.-H., C. R. xxxi. p. 876 (1850); id. Cat. méth. p. 71 (1851); A. Milne-Edwards et A. Grandidier, op. cit. pl. 191 (cranium).

Prosimia rufipes, J. E. Gray, Ann. Mag. Nat. Hist. (4) vii. p. 339 (1871); id. Proc. Zool. Soc. Lond. 1872, p. 852, pl. 69 (nec Milne-Edwards, P. Z. S. 1893, p. 177).

At the Society's meeting of May 2, 1899², I gave expression to some doubt against the correctness of the view brought forward by Milne-Edwards³, that Gray's *Prosimia rufipes* is the female of Sclater's *Lemur nigerrimus*. My observations may be epitomized as follows:—

- (1) Gray's species was based upon a male and a female specimen, both of them rufous.
- (2) I myself have collected numerous specimens of both sexes

¹ This is seen also in Grandidier's plate 189. figs. 3, 6 (" *Lemur mongoz* ") & pl. 193. figs. 3, 6 (" *Lemur albinus* "). Von Lorenz had already rightly guessed that the latter plate does not represent the skull of *Lemur albinus* (= *L. mongoz*, L.).

² Proc. Zool. Soc. Lond. 1899, pp. 553, 554.

³ Proc. Zool. Soc. Lond. 1893, pp. 177, 178.

of the same as Gray's species, and have never met with a black male.

- (3) According to Schlegel's view, Gray's *Prosimia rufipes* is a synonym of I. Geoffroy S.-H.'s *Lemur rubriventer* and *Lemur flaviventer*, the latter being the female, the former the male form. The difference in coloration between the sexes of *Lemur rubriventer*—which name antedates *Prosimia rufipes*—would therefore appear merely to consist in a lighter coloration of the underparts in the female.

This view I found to be supported by my own material also.

- (4) In the specimens collected by myself, the iris is yellow and not greenish blue, as is the case, according to Milne-Edwards, with *Lemur nigerrimus*.
- (5) The skull of one of the two types of *Prosimia rufipes*¹, which agrees perfectly with those collected by myself, is very different from the skull of *L. nigerrimus* figured in the 'Hist. Nat. de Madagascar.'

The conclusion was that Gray's *Prosimia rufipes*, which is I. Geoffroy's *Lemur rubriventer* and *L. flaviventer*, is a very different species from *Lemur nigerrimus*. Not having seen the types of *L. rubriventer* and *flaviventer*, nor any specimen of *L. nigerrimus*, I expressed myself in perhaps too cautious a manner, although at that time already the matter was settled in my opinion. Thereby I did not wish in the least to cast a doubt on Milne-Edwards's statement with regard to the colour of the female *Lemur nigerrimus*. His mistake is easily explained by the circumstance that in the description of the types of *Prosimia rufipes* none of the very characteristic features of the species are mentioned: the accompanying plates are inaccurate even with regard to the coloration.

I have, since the date of my first note, been able to examine (1) a couple of *Lemur rubriventer*, deposited some time ago in the Society's Gardens by the Hon. Walter Rothschild; (2) one of the types of Geoffroy's *Lemur flaviventer*, in the Leyden Museum, it was obtained in 1834 by Bernier and received in 1835 from the Paris Museum; (3) a skull of the adult male of *Lemur nigerrimus*, presented last year by Mr. Stanley Flower to the Natural History Museum.

From an inspection of the individuals living in the Gardens, any one may convince himself that the male of *Lemur rubriventer* is not black; and that the iris in both is yellow, and not greenish blue as in *Lemur nigerrimus* according to Milne-Edwards. A third point which needed explanation, is elucidated by them. In a recent book on Primates—in which, by the way, quite a number of original observations are embodied, although it does not pretend to be more than a compilation—the description of the male of *Lemur rubriventer* contains the following: "a ring round the eyes cobalt-blue"². This peculiar statement is easily traceable back to

¹ The skull has not been taken out of the second mounted specimen.

² H. O. Forbes, A Handbook to the Primates, i. p. 76 (1894).

the coloured figure of the male of *Lemur rubriventer* in the Hist. Nat. de Madagascar¹. Having known the *Lemur rubriventer* in life, without ever having seen this "cobalt-blue" ring in the male, I had already arrived at the conclusion that it was merely the outcome of the artist's highly coloured imagination. The specimens in the Gardens show that the region in question has in both sexes about the coloration of the lower figure in plate 169 of the quoted work, viz. dark grey with a bluish tinge.

The examination of one of the types of Geoffroy's *Lemur flaviventer* in the Leyden Museum showed that Schlegel was perfectly justified in considering this form to be the female of *Lemur rubriventer*. Apart from the slight variation in the coloration, the two agree absolutely in all other features, including the very characteristic conformation of the cranium.

The skull of a male *Lemur nigerrimus* presented by Mr. Stanley Flower² agrees in almost every particular with the one figured in Grandidier's work³, and is therefore very distinct from the skull of *L. rubriventer*.

Lemur rubriventer has, in fact, very few of the characteristic features of the other species of the genus, but on the other hand some striking peculiarities of its own; and I perfectly remember how much I was puzzled when I first met with this species in the forests of Ivoihimanitra. The head is roundish, the face being much less produced and the hinder portion broader than in all the other species. The ears are comparatively small, hairy and hidden, as it were, in the fur, as already perfectly characterized by Schlegel⁴.

The skull is short and broad, and massive; the facial cranium remarkably short for a *Lemur*⁵. But the most peculiar feature in the skull of this species is a pneumatic cavity, developed in the palatal and which, with the increase in age of the animal, becomes so much enlarged that it pervades the whole of the bottom of the orbit, and, in the basis cranii, considerably narrows the posterior openings of the nares (Pl. XXII. fig. 7). In an advanced foetus the *pars perpendicularis* of the palatal exhibits already, just above the posterior margin of the bony palate, the opening of a small recess, which extends in a supero-lateral direction; as a consequence, the palatal appears slightly inflated in the orbit. In the next stage available (Pl. XXII. fig. 6, a young individual), the opening of the incipient sinus is oval-shaped, its long axis parallel to the long axis of the cranium; it is situated almost entirely behind the bony palate, so that it is visible in the horizontal lower view of

¹ Pl. 167.

² Brit. Mus. Z. D. No. 0.8.6.21; from the Ghizeh Zool. Gardens. This specimen bred with a ♀ *L. macaco*, and the young is stated to have been like the mother.

³ Pl. 188.

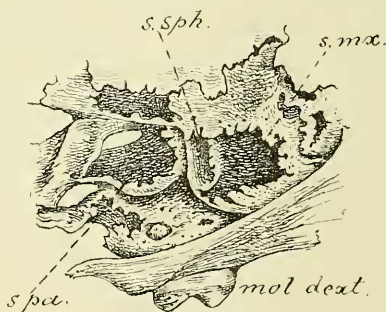
⁴ "Oreilles passablement petites, fortement velues dans toute leur étendue et comme cachées dans le pelage de la tête." (Monogr. Singes, p. 311.)

⁵ Grandidier's plate 191 (" *Lemur flaviventer* ") conveys a good general idea of the skull of *Lemur rubriventer*.

the skull. In the orbit (Pl. XXII. fig. 1) the inflated part of the palatal appears situated medially from the orbital plate of the maxilla, and medially as well as posteriorly from the os planum; the latter helps to form the posterior prolongation of the maxillary sinus and covers besides the anterior prolongation of a sphenoidal sinus, laterally it is in its turn covered by the frontal.

In this stage the palatal pneumatic cavity rather resembles the swollen orbital maxillary plate above the germs of the molars of young individuals; so that, if it has ever been seen at all, it may have been mistaken for that part of the maxilla. As the figures (Pl. XXII. figs. 1, 2) show, both parts are lying side by side and are very distinct from each other. With the increase in age of the animal, the palatal pneumatic cavity continues to pervade the orbit in every direction, antero-posteriorly as well as laterally and medially (Pl. XXII. fig. 3). Anteriorly, the hinder portion of the maxillary sinus is the loser in the struggle, for it is gradually encroached upon and pushed forward by the palatal sinus; but I am not aware that a communication between the two cavities takes place. The palatal cavity becomes, however, enlarged at the cost of another sinus; in a youngish specimen (*m.3* not yet in place) the following can be seen owing to its somewhat damaged condition (see text-fig. 70):—the before-mentioned sphenoidal

Text-fig. 70.

*Lemur rubriventer.*

Right orbital region. The bones forming the floor have been partially removed, in order to exhibit the disposition of the underlying sinuses. About $\frac{3}{2}$ nat. size.

s.sph.=sphenoidal sinus; *s.max.*=maxillary sinus; *s.pa.*=palatal sinus.

sinus (*s.sph.*), which in the posterior part of the orbit runs parallel to the palatal cavity, medially from it, finally turns round in a lateral direction, ending in a *cul-de-sac* between the maxillary (*s.max.*) and the palatal sinus (*s.pa.*), thus separating the two. As in later stages I have found no more trace of this *cul-de-sac*, its place being occupied by the palatal sinus (text-fig. 70), it is evident that it must have been absorbed by the latter.